

Greetings and welcome to the **OCTOBER 2015** edition of the WDFW Climate News Digest. Our purpose is to provide highlights of relevant climate change news, events and resources for WDFW staff. Feedback or suggestions for items to include in future editions are much appreciated – many *thanks* to those who have sent links and references and please keep them coming. Note that previous editions of the newsletter are now stored on the [Habitat Program Sharepoint](#) site and on the agency's [climate change web page \(which will be updated soon!\)](#).

Thanks for contributions this month from Lisa Hallock, Jason Wettstein, Dawn Phelps, Wendy Connally and Dan Siemann (DNR)

WHAT'S HAPPENING AT WDFW?

Are you working on a project that may be affected by climate change? Have you considered or included climate change in research proposals, workshops or other activities? Please be in touch to share your experience!

November 13, 10:00 to 1:00 pm in Olympia – Workshop: Integrating Climate Change into Culvert Design
WDFW is hosting a workshop to share final results of a project, funded by the North Pacific Landscape Conservation Cooperative, to explore options for integrating future climate projections into agency culvert design and permitting processes. The audience will include agency staff involved in water crossing design and permitting as well as others from outside the agency interested in this topic. For more information or to reserve a spot, please contact Lynn Helbrecht at lynn.helbrecht@dfw.wa.gov or (360) 902-2238. Copies of the draft report from this project are expected to be available by early November. *Note – this workshop follows up an earlier technical workshop offered in June.*

CLIMATE ADAPTATION AT OTHER ORGANIZATIONS

Restoring Tidal Flow and Enhancing Shoreline Resilience in the Nisqually River Delta

The Nisqually Delta Restoration Project is the largest tidal marsh restoration effort in the Pacific Northwest. Over four miles of dikes were removed in 2009 to return tidal flow to roughly 762 acres in the Nisqually National Wildlife Refuge in Washington State to enhance wildlife habitat and the buffering capacity of marshes to sea level rise and increased flooding. Along with other local restoration efforts, 22 miles of the historic delta system have been restored, increasing salt marsh habitat in southern Puget Sound by over 50 percent. Since 2009, scientists have closely monitored changes to the ecosystem using aerial photographs, permanent land-based panoramic photographs, sediment gauges, vegetation transects, bird and fish counts, and tidal gauges; results indicate that the historical delta ecosystem is returning and that the dike removal has increased the area's salmon population.

RESOURCES

Climate Commons

California land and resource managers can find information, maps, tools, and data to support climate-smart conservation in their regions. The California Landscape Conservation Cooperative offers resources for getting started and going deeper with adaptation plans

Climate Data Record

[Sea Surface Temperature and Sea Ice Coverage Map Viewer](#). Observe global patterns of sea surface temperature and sea ice extent over time with this digital map viewer from the National Centers for Environmental Information (NCEI).

Climate Aquatics Blog - USFS

The intent of the Climate-Aquatics Blog is to provide a means for the field biologists, hydrologists, students, managers, and researchers to more broadly and rapidly discuss topical issues associated with aquatic ecosystems and climate change. Messages periodically posted to this blog will highlight peer-reviewed research and science tools that may be useful in addressing this global phenomenon. A forum for group discussions of these tools and new scientific findings has been set up as a Google Group ([instructions for joining](#)). Here, we've stored the text of the original Blog posts, supporting graphics, and peer-reviewed articles because the latter cannot be uploaded to the Google Group.

LEARNING OPPORTUNITIES

October 5 - 12:00-1:00 pm, Department of Health Green Bag, **"Warming in the Northeast Pacific or: How I Learned to Stop Worrying and Love the Blob"**, featuring Nick Bond, State Climatologist at the Office of the State Climatologist. Join in person October 5 from 12-1pm in PPE 152-153. in person at the Tumwater campus (PPE 152-153) or via [webinar](#). Email ann.butler@doh.wa.gov for more information.

October 14 – 11:00 am (Pacific), **" Identifying Resilient Terrestrial Landscapes in the Pacific Northwest"** with speakers Ken Popper and Steve Buttrick. TNC's project identified the most resilient landscapes in the Northwest that could best sustain native diversity under climate change impacts and showcased these areas through comprehensive data maps. The project covered 92 million hectares across six states and eleven ecoregions. You can also view a recording of the similar [September 9th webinar here](#).

October 22 – Conference, Seattle, WA: 2015 AWRA Washington State Conference - Water Management Strategies in the Face of Climate Change

November 4-5 — Sixth Annual Northwest Climate Conference – Coeur d'Alene, Idaho

The NW Climate Conference (formerly known as the Pacific Northwest Climate Science Conference) annually brings together more than 250 researchers and practitioners from around the region to discuss scientific results, challenges, and solutions related to the impacts of climate on people, natural resources, and infrastructure in the Northwest. It is the region's premier opportunity for a cross-disciplinary exchange of knowledge and ideas about regional climate, climate impacts, and climate adaptation science and practice.

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December 1-3 – "Climate Adaptation for Coastal Communities", a new course taught by national experts from NOAA and held at the Padilla Bay Reserve from 9 am-4:30 pm. This three-day course will help you recognize the variability in climate's influence on coastal (and inland shoreline) communities, Identify opportunities to leverage a range of governance mechanisms to integrate adaptation strategies into their existing efforts, examine methods for conducting hazard, vulnerability, and risk assessment as it relates to climate change and more. The cost of the class is \$195 and includes lunch and materials. To register, please go to <http://www.coastaltraining-wa.org>.

CLIMATE SCIENCE NEWS

Risk of very large fires could increase sixfold by mid-century in the US

From Climate.Gov

Warming due to increasing greenhouse gas emissions will likely increase the potential for 'very large fires'—the top 10 percent of fires, which account for a majority of burned areas in many regions of the United States. Climate change is expected to both intensify fire-friendly weather conditions, as well as lengthen the season during which very large fires tend to spread. In most places, the projected changes met the following criteria: at least 90% of the models agreed on the sign of change, and the predicted change exceeded two standard deviations of the twentieth-century mean. In other words, in most places, the models agreed that the risk of very large fires would increase, and that the change would be large compared to historic natural variability. Barbero, R.; Abatzoglou, J.T.; Larkin, N.K.; Kolden, C.A.; Stocks, B. 2015. [Climate change presents increased potential for very large fires in the contiguous United States](#). International Journal of Wildland Fire.

September 2015 El Niño Update and Q&A

From Climate.Gov - The [CPC/IRI ENSO forecast](#) says there's an approximately 95% chance that El Niño will continue through Northern Hemisphere winter 2015-16, gradually weakening through spring 2016.

NASA zeroes in on ocean rise: How much? How soon?

From —Science Daily

Seas around the world have risen an average of nearly 3 inches (8 centimeters) since 1992, with some locations rising more than 9 inches (25 centimeters) due to natural variation, according to the latest satellite measurements from NASA and its partners. The data reveal the height of the sea surface is not rising uniformly everywhere. Regional differences in sea level rise are dominated by the effects of ocean currents and natural cycles such as the Pacific Decadal Oscillation. But, as these natural cycles wax and wane, they can have major impacts on local coastlines. "Sea level along the west coast of the United States has actually fallen over the past 20 years because long-term natural cycles there are hiding the impact of global warming," said Josh Willis, an oceanographer at NASA's Jet Propulsion Laboratory in Pasadena, California. "However, there are signs this pattern is changing. We can expect accelerated rates of sea level rise along this coast over the next decade as the region recovers from its temporary sea level 'deficit.'

El Niño may accelerate nuisance flooding

According to a new NOAA [report](#), many mid-Atlantic and West Coast communities could see the highest number of nuisance flooding days on record through April due to higher sea levels and more frequent storm surge, compounded by the strengthening El Niño, which is likely to continue into the spring. These communities may experience a 33 to 125 percent increase in the number of nuisance flooding days, the report said. These findings build upon two nuisance flooding reports issued last year, which show coastal communities in the United States have experienced a rapid growth in the frequency of nuisance tidal flooding, a 300 to 925 percent increase since the 1960s, and will likely cross inundation tipping points in the coming decades as tides become higher with sea level rise.

2015 Arctic sea ice fourth lowest on record

On September 11, 2015, Arctic sea reached its fourth-lowest minimum extent in the satellite record. The National Snow and Ice Data Center (NSIDC) released its preliminary announcement Tuesday, saying that Arctic sea ice melted down to 1.70 million square miles (4.41 million square kilometers). [Read more...](#)

How likely is it that 2015 will be the new warmest year on record? – from Climate.Gov

Global surface temperatures have remained at or near record-warm levels throughout 2015, leading many to prognosticate that 2015 will eclipse 2014 as the warmest year on record, perhaps by a relatively large margin. We estimate a 97% probability that 2015 will become the warmest year on record.

2014 State of the Climate – report released

In 2014, the most essential indicators of Earth's changing climate continued to reflect trends of a warming planet, with several markers such as rising land and ocean temperature, sea levels and greenhouse gases -- setting new records. These key findings and others can be found in the State of the Climate in 2014 report released online by the American Meteorological Society (AMS). The report, compiled by NOAA's Center for Weather and Climate at the National Centers for Environmental Information is based on contributions from 413 scientists from 58 countries around the world. It provides a detailed update on global climate indicators, notable weather events, and other data collected by environmental monitoring stations and instruments located on land, water, ice, and in space.

The simple statistic that perfectly captures what climate change means

From the Washington Post (Chris Mooney)

There are many ways to measure the world's changing climate. You can chart rising global temperatures, rising sea levels and melting ice. What's tougher, though, is to find a measurement that easily relates all of that to what people experience in their daily lives. In a new study in Geophysical Research Letters, however, two Australian researchers do just this by examining a simple but telling meteorological metric — the ratio of new hot temperature records set in the country to new cold temperature records. “In a stationary climate, a climate where we don't have any trend or long-term change, we expect hot and cold records to be broken at almost the same rate,” explains Sophie Lewis, the lead study author and a researcher at the Australian National University in Canberra. “But in the last 15 years, we see a dramatic increase in the frequency of hot records and the decrease of cold records.”

SPECIES AND HABITATS

Climate Change is shortening bumblebee tongues

From University of Washington's Conservation Magazine

Climate change is predicted to cause plants and animals to migrate to new locations, and reshuffle biotic communities in various ways. Now, scientists have documented not just predictions but concrete evidence of climate change driving the evolution of bumblebees that forage in the mountains of Colorado.

Caribou, mosquitos and global warming

From University of Washington's Conservation Magazine

Global warming will boost the survival rate of mosquitoes in the Arctic, researchers have found. As a result, caribou may suffer more bloodsucking bites. And the bugs aren't just a minor annoyance. “Insect harassment” could drive the caribou to areas with less food, ultimately compromising their ability to nurture calves

Pygmy rabbit vulnerability to climate change documented in a new study

The pygmy rabbit ranked extremely vulnerable to climate change in this study using the NatureServe Vulnerability Index. The pygmy rabbit's diet and habitat are primarily based on the sagebrush plant, which does not respond well to warming temperatures, further increasing its vulnerability to fire and invasive species.

Novel competitors affect species' responses to climate change

—Science Daily

To explore how species' responses to climate warming depend on how their competitors migrate to track climate, this study showed that when alpine plants were transplanted to warmer climates to simulate a migration failure, their performance was strongly reduced by novel competitors that could migrate upwards from lower elevation; these effects generally exceeded the impact of warming on competition

with current competitors. In contrast, when focal plants were grown under their current climate to simulate climate tracking, a shift in the competitive environment to novel high-elevation competitors had little to no effect. This asymmetry in the importance of changing competitor identity at the leading versus trailing range edges is best explained by the degree of functional similarity between current and novel competitors. We conclude that accounting for novel competitive interactions may be essential to predict species' responses to climate change accurately.

For Fragile Drylands, climate is crushing

From the University of Washington Conservation Magazine

Biocrusts are the foundation of dryland ecosystems: they fix carbon and nitrogen, regulate water flow, and hold soil in place, preventing erosion and dust storms. Researchers have long known that these crusts are vulnerable to trampling by humans, livestock, or vehicles. Now, researchers with the U.S. Geological Survey have found that climate change affects biocrusts in a similar way and to an equally dramatic degree as physical disturbance

A new model projects that 2015's dry conditions could be common by the 2070s, affecting the Cascades frog and other mountain species

Far above the wildfires raging in Washington's forests, a less noticeable consequence of this dry year is taking place in mountain ponds. The minimal snowpack and long summer drought that have left the Pacific Northwest lowlands parched also affect the region's amphibians due to loss of mountain pond habitat. According to a new paper published Sept. 2 in the open-access journal *PLOS ONE*, this summer's severe conditions may be the new normal within just a few decades.

Se-Yeun Lee, Maureen E. Ryan, Alan F. Hamlet, Wendy J. Palen, Joshua J. Lawler, Meghan Halabisky. Projecting the Hydrologic Impacts of Climate Change on Montane Wetlands. *PLOS ONE*, 2015; 10 (9): e0136385 DOI: 10.1371/journal.pone.0136385

Biodiversity belowground is just as important as above ground

From Science Daily

Although most of the world's biodiversity is below ground, surprisingly little is known about how it affects ecosystems or how it will be affected by climate change. A new study demonstrates that soil bacteria and the richness of animal species belowground play a key role in regulating a whole suite of ecosystem functions on Earth. The authors call for far more attention to this overlooked world of worms, bugs and bacteria in the soil.

Shifting Effects of Ocean Conditions on Survival and Breeding Probability of a Long-Lived Seabird

Here, we model the relationships between ocean conditions and the demography of a long-lived seabird, Brandt's cormorant (*Phalacrocorax penicillatus*), in central California and show that these relationships have changed in recent years. Beginning in 2007/2008, the response of Brandt's cormorant, an upper trophic level predator, to ocean conditions shifted, resulting in lower than predicted survival and breeding probability.

Climate change will irreversibly force key ocean bacteria into overdrive

From University of Southern California

The levels of ocean acidification predicted for the year 2100 have been shown to cause an irreversible evolutionary change to a bacteria foundational to the ocean's food web. Imagine being in a car with the gas pedal stuck to the floor, heading toward a cliff's edge. Metaphorically speaking, that's what climate change will do to the key group of ocean bacteria known as *Trichodesmium*, scientists have discovered.

Trichodesmium (called "Tricho" for short by researchers) is one of the few organisms in the ocean that can "fix" atmospheric nitrogen gas, making it available to other organisms. It is crucial because all life -- from algae to whales -- needs nitrogen to grow. A new study from USC and the Massachusetts-based Woods

Hole Oceanographic Institution (WHOI) shows that changing conditions due to climate change could send Tricho into overdrive with no way to stop -- reproducing faster and generating lots more nitrogen.

Improving vulnerability assessments by understanding species adaptive capacity

A new study has been published in *Conservation Letters* that examines the ability for species to adapt to climate change. The study was a collaborative effort between the USGS, Massachusetts Division of Fisheries and Wildlife, the National Research Council, EPA, Fish and Wildlife Service, NOAA, NPS and various universities and nonprofits. Characterizing the vulnerability of a given species to climate change depends on the sensitivity of the species and the ability of the species to accommodate climate-induced changes through adaptive capacity. This includes various coping mechanisms, such as changes in behavior, shifting geographical range and distribution, and genetic evolution. The study found that adaptive capacity is often omitted in vulnerability assessments or confused with sensitivity, yet it is critical to understand how species will respond to climate change to improve decision-making on natural resources and conservation.

<https://nccwsc.usgs.gov/content/new-study-encourages-inclusion-adaptive-capacity-when-assessing-vulnerability>

Climate Change Effects Along a Latitudinal Gradient in the Pacific Northwest

The USGS National Climate Change and Wildlife Science Center has completed a three-year long study investigating the effects of sea-level rise on nine tidal marshes in Washington and Oregon. The project concludes that multiple factors, including initial elevation, marsh productivity, sediment availability, and rates of sea-level rise, affected marsh persistence. Under a low sea-level rise scenario, all marshes remained vegetated with little change in the present configuration of marsh plant communities or gradually increased proportions of mid, high, or transition marsh vegetation zones. However at most sites, mid sea level rise projections led to loss of middle and high marsh and gain of low marsh habitat. Under a high sea level rise scenario, marshes at most sites eventually converted to intertidal mudflats. Two sites (Grays Harbor, and Willapa) appeared to have the most resilience to a high sea-level rise rate, persisting as low marsh until at least 2110. Their main model finding is that most tidal marsh study sites have resiliency to sea-level rise over the next 50-70 years, but that sea-level rise will eventually outpace marsh accretion and drown most high and mid marsh habitats by 2110.